

Crystal ball: Bond Enthalpy calculations

All of the following questions have not (as yet!) appeared in the NCEA Level 2 Exams

Average bond enthalpies at 298 K

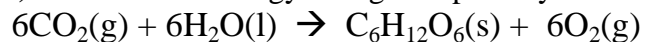
Bond	ΔH (kJ mol ⁻¹)	Bond	ΔH (kJ mol ⁻¹)
H-H	436	C-H	412
C-C	348	N-H	388
C=C	612	O-H	463
C≡C	837	Cl-H	431
N-N	163	C=O	743
N=N	409	C-N	305
N≡N	944	C=N	613
O-O	146	N≡C	890
O=O	496	C-Cl	338
Cl-Cl	242	Si-O	374

reference: 2007, International Baccalaureate Organization Chemistry Data booklet

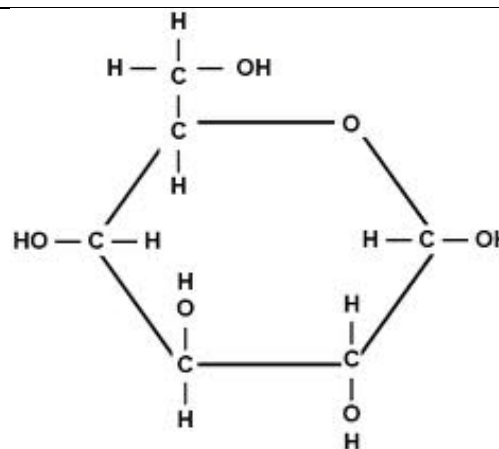
1) Calculate the bond enthalpies for this reaction: $\text{CH}_2\text{CH}_2(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$

2) Use the equation of the Haber process to calculate the average bond enthalpy value for the N-H bond
 $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g}) \quad \Delta_r H = -92 \text{ kJ mol}^{-1}$

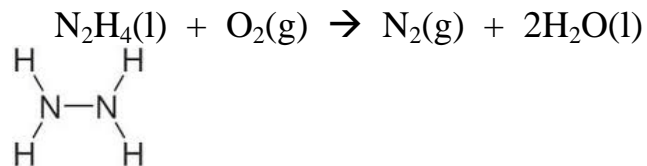
3) Calculate the energy change for photosynthesis



The structure of glucose is shown below

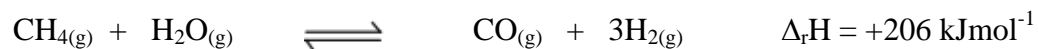


4) Hydrazine was first used as a rocket fuel during World War II. The equation below shows the combustion of hydrazine, use it and the bond enthalpy values to calculate the bond enthalpy value for this reaction.



5) Calculate the heat of reaction for the combustion of butane when completely burned in oxygen

6) Carbon monoxide can be formed from the reaction of methane gas with steam. The following endothermic reaction absorbed 206 kJ mol⁻¹ of energy, calculate the bond enthalpy for the C≡O bond in carbon monoxide.



7) Use the bond enthalpy values in the table above and these values S-S 264 kJ mol⁻¹ and S=S 352 kJ mol⁻¹ to suggest a reason why 8 sulfur atoms tend to form one S₈ molecule whereas 8 oxygen atoms tend to form four O₂ molecules